SOLAR TRACKING SYSTEM

MINI PROJECT- I REPORT

Submitted by

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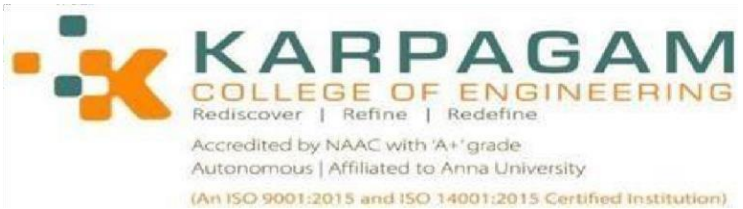
in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING



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ABSTRACT

Of all the renewable energies, solar energy is the only energy gained its popularity and importance quickly. Through the solar tracking system, we can produce an abundant amount of energy which makes the solar panel's workability much more efficient. Perpendicular proportionality of the solar panel with the sun rays is the reason lying behind its efficiency. Pecuniary, its installation charge is high provided cheaper options are also available. This project is discussed all about the design and construction mechanism of the prototype for the solar tracking system having a single axis of freedom.

The main control circuit is based upon NodeMcu microcontroller. Programming of this device is done in the manner that the LDR sensor, in accordance with the detection of the sun rays, will provide direction to the DC Motor that in which way the solar panel is going to revolve. Through this, the solar panel is positioned in such a manner that the maximum amount of sun rays could be received. In comparison with the other motors, DC motor is the simplest and the suave one, the torque of which is high and speed of which is slow enough. We can program it for changing the direction notwithstanding the fact that it rotates only in one direction subject to exception as far as programming is concerned. 1985, first time ever it was witnessed for production of the silicon solar cells with an efficiency of 20%. Though a hike in the efficiency of the solar panel had a handsome increase still perfection was a far-fetched goal for it. Below 40%, most of the panels still hover to operate. Consequently, peoples are compelled to purchase a number of panels in order to meet their energy demands or purchase single systems with large outputs. Availability of the solar cells types with higher efficiencies is on provided they are too costly to purchase

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADT American District Telegraph

CCTV closed-circuit television surveillance

GSM Global System for Mobile Communications

ICSP In-circuit serial programming

IR Infrared

LDR light-dependent resistor

LED Light Emitting Diode

PCB Printed Circuit Board

PIR Passive Infrared

PWM Pulse Width Modulation

SPI Serial Peripheral Interface

TWI Two Wire Interface

USB Universal Serial Bus

CHAPTER 1

INTRODUCTION

GENERAL BACKGROUND

Bustling civilization is the vein through which modern civilization is operated. Energy day by day is put to use at its best to fulfil the desires and ambition of the peoples at large. Each and every corner of our life is caged with various layers of impediment and in this response, energy is becoming an indispensable factor. Therefore, the source of energy needs to be endless/ perpetual in order to carry this colossal population ahead. Human beings being evolutionary in nature are perhaps the best ever creation of nature is always in the race of envisaging the probable and available comforts and benefits in every possible angle in this perilous world. The evidential matrix manifests that in a dichotomy of various opinions what options best expedite the scarcity of energy in an immensely heterogeneous society like ours. Our motto is to endeavour in forwarding such noble goal of energy conservation.

Taking a look at the present scenario it is evident that conventional sources of energy such as coal, natural gas, oil, etc. are at the edge of extinction. Being in mortal combat with time itself to fulfil every demand for energy the demand for these resources for energy has escalated to its zenith. The conventional use of energies due to the burning of fossil fuels like coal, oil and natural gas, the whole environment is getting polluted. The present project, therefore, is orchestrated with components like LDR module, DC Motor, Photovoltaic array etc, would not emit any pollution and in turn act as a reservoir of energy taken from the Sun itself. As adumbrated no other energy is more abundant than solar energy as per as its availability and freeness are concerned, utilization of which, compounded with rest of the fact of its conversion into electrical energy. Historically if counted, in the year 1881 for the first time ever solar panel was invented. The DC Motor adjacent with the system with the help of LDR module by measuring the intensity of the sun rays fixed on the upper edge of the solar panel will help the solar panel to revolve around proportionately with the movement of the Sun itself in order to grab and store .

WORKING PRINCIPALE

Solar panels are a cumulative orientation of photovoltaic cells. The PV cells are arranged in a solar panel or a PV array such that is serves the purpose of exciting the electron of the material consisting inside the solar cells using photons. The average amount of sunlight received by solar panels particular depends on the position of the sun. [6]

Being a repository of energies, Sun witnessed to be the eminent and ever continuing source of emitting radiation from it. A part of this source of natural energy is received by the solar panel. Certain ways have been developed to utilize this energy source as an alternative to other non renewable sources. Considering its multitudinous flourishing ways in which it can be applied to bring about the change in conserving other resources, the manipulation of the energy source is encouraged. [7]

Solar panels are hence used to utilize solar power in electrical means. They are aligned different arenas to collect maximum solar power. Though, solar panels can be used to absorb or collect solar power, there work is bounded to certain hours of the day and the sunlight pouring directly on them, i.e. the angle between the sunrays and the panel is orthogonal. While at other hours of the day, the angle of the sunrays is different, hence the amount of the solar power captured is very less. To overcome such pitfalls, and encapsulate the maximum available of solar energy the solar tracking systems were introduced. A solar tracking system is designed with the intention of keeping the angle between the sunrays and the solar array 90°. The solar tracking system have three different modules.

- The mechanism
- Driving motors
- Thetrackingcontrol

ler

The mechanism is accountable to furnish with accurate movements, in the sake of following the footsteps of the sun throughout the day. The prototype of the device is made durable enough to withstand unfavorable weather condition. This mechanism of the solar tracking systems classifies themselves into two segments single axis tracker, dual axis tracker.[8]

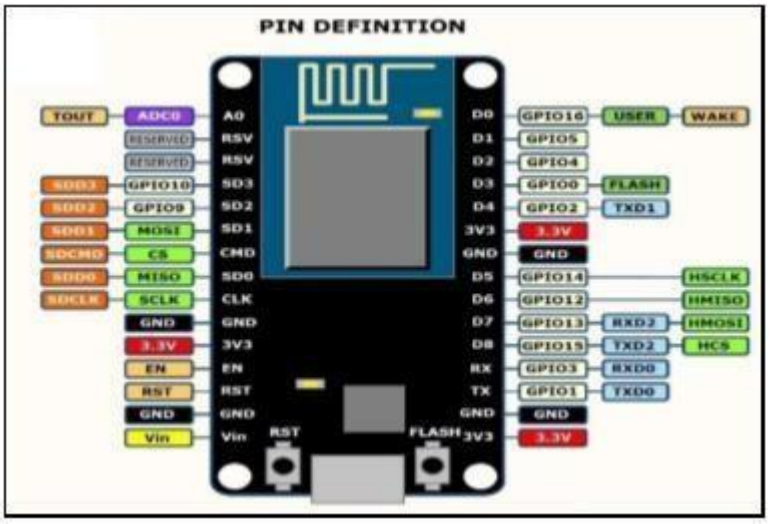
CHAPTER 2

PROJECT DESCRIPTION

HARDWARE REQUIREMENTS

3.1 NODEMCU:

NodeMCU is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. In this crystal ball project arduino is used to display the message on the LCD according to the code written in the arduino software, Whenever the tilt switch senses the moment of bread board and sends the signals to the arduino.



3.1 pin diagram of Node MCU

3.2 L293D MOTOR DRIVER MODULE:

L293D Motor Driver Module is a medium power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L293 motor driver IC. It can drive 4 DC motors on and off or drive 2 DC motors with directional and speed control.

The driver greatly simplifies and increases the ease with which you may control motors, relays, etc from micro-controllers. It can drive motors up to 12V with a total DC current of up to 600mA.

You can connect the two channels in parallel to double the maximum current or in series to double the maximum input voltage. This motor driver is perfect for robotics and mechatronics projects for controlling motors, switches, relays, etc from microcontrollers. Perfect for driving DC and Stepper motors for micro mouse, line-following robots, robot arms, etc.

3.1 LD293 MOTOR DRIVER

3.3 The Driving Motors (DC Motor)

Donning with the instruments like an axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), brushes, DC motor could be found to have many applications. This chapter unfolds the logical understanding of the operation and construction of the DC motors.

DC motor has the characteristics of low power consumption, large torque, low noise, small size, light weight, and easy to use. The DC motor used as actuator in the system has maximum angular speed of 10 rpm and 12 V of voltage supply. It is can move or rotate smoothly, as shown in Figure 4.2. Direction and speed of the DC motor represent plant outputs. In this case, the direction of DC motor can

be set using the motor driver module, namely L293D. As stated previously that the DC motor will be in off -

3.2 DC MOTOR

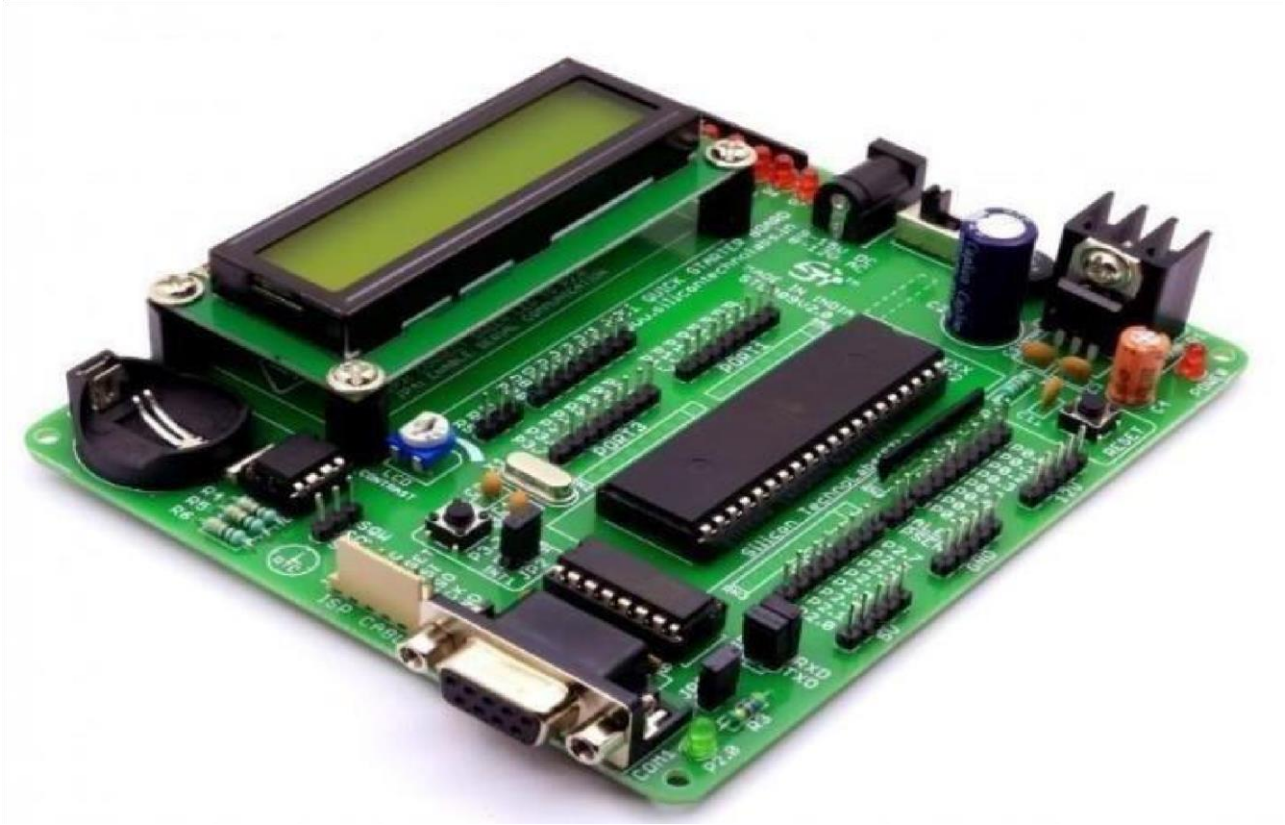
3.5 MICROCONTROLLER:

The two LDR's are used to give triggering signal to microcontroller.

The output of the LDRs is analog but the microcontroller needs its inputs in digital form, hence the output of LDRs' is converted to digital using inbuilt ADC.

Depending upon the LDR's output, microcontroller decides the rotation action i.e. clockwise or anticlockwise. After morning at time suppose 10:00 AM, the west LDR output will be greater than the output of east LDR

In this situation the microcontroller sends the signal such that the DC motor will rotate the panel in anticlockwise direction.



3.3 microcontroller

3.4 Solar cell

The solar input comprises of the solar panel and two modules of photo sensors, each of which is joined to the solar panel along its length on either side of the panel. The solar panel is supported to the wooden base by the mechanical structure. The photo sensors are hence, connected to the controlling circuit

In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat. A "photoelectrolytic cell" (photoelectrochemical cell), on the other hand, refers either to a type of photovoltaic cell (like that developed by Edmond Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen using only solar illumination.

3.4 Solar cell

3.5 LDR (Light Dependent resistor)

The figure depicts the notion for the instalment of the light dependent resistors (LDR). A secure state is attained when the light intensities of the two LDR become the same. The principal source of light energy, the Sun, moves from east to west. This movement of the Sun causes the variation in the level of light intensities falling on the two LDRs. The designed algorithm compares the variation in the light intensities inside the microcontroller and the motor then is operated to rotate the solar panel, so it moves aligned with the trail of the light source

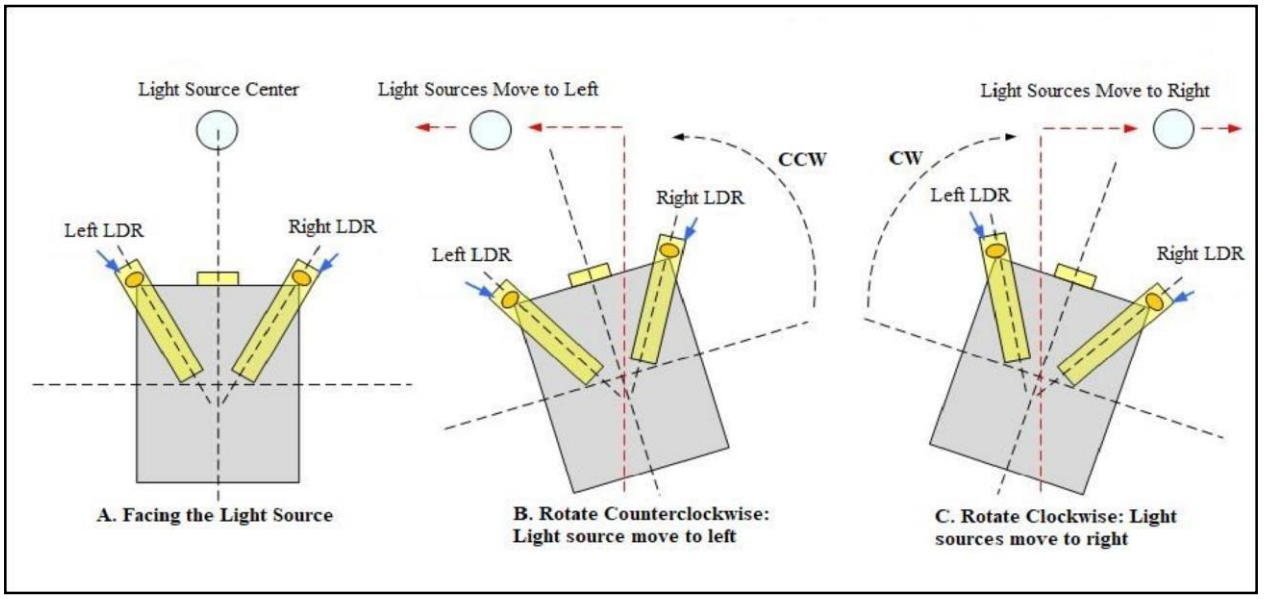


Figure2.3: Concept of using Two LDR

3.6 FIXED COLLECTOR:

The fixed collectors are secured at a place where the gross solar energy obtained is comparatively higher than most of the predefined places and is the inclination is kept in accordance with the defined context. The motive is to install collected places which are subjected to receive the maximum amount of sunlight and collect solar energy over a long period of time hence the demand for tracking devices can be overcome. This creates a substantial diminution in the expenses and the preservation of the collectors. The knowledge of the movement of the sun throughout a season and different hours of the year is essential to enable maximum captivation of solar energy**.**

3.6 fixed collector

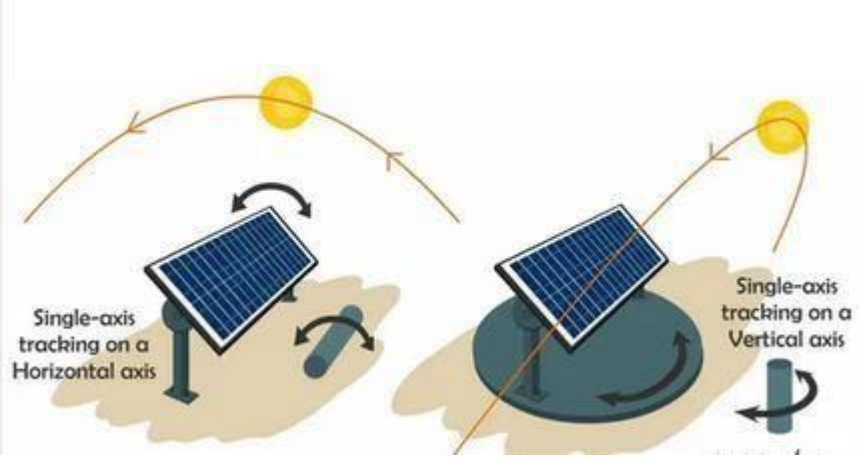
3.7 mechanical structure

Single & dual axis Solar tracking system:

- Tracks in a single cardinal direction.
- It has a single row tracking configuration.
- More reliable.
- It has a longer lifespan.

The common categories in which single axis trackers can be classified holds:

- Horizontal single axis trackers (HSAT).
- Horizontal single axis tracker with tilted modules (HTSAT).
- Vertical single axis tracker (VSAT).
- Tilted single axis tracker (TSAT).
- Polar aligned single axis tracker (PSAT).



Dual axis:

- It moves along two cardinal directions (Horizontal & Vertical).
- The axes are traditionally orthogonal.
- Its efficiency is much more than any single Axis Tracker.

- It conventionally follows the movement of the sun and hence captivates maximum solar radiations.

3.8 BATTERY:

A battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode.

3.7 Battery +5v

CHAPTER 3

BLOCK DIAGRAM

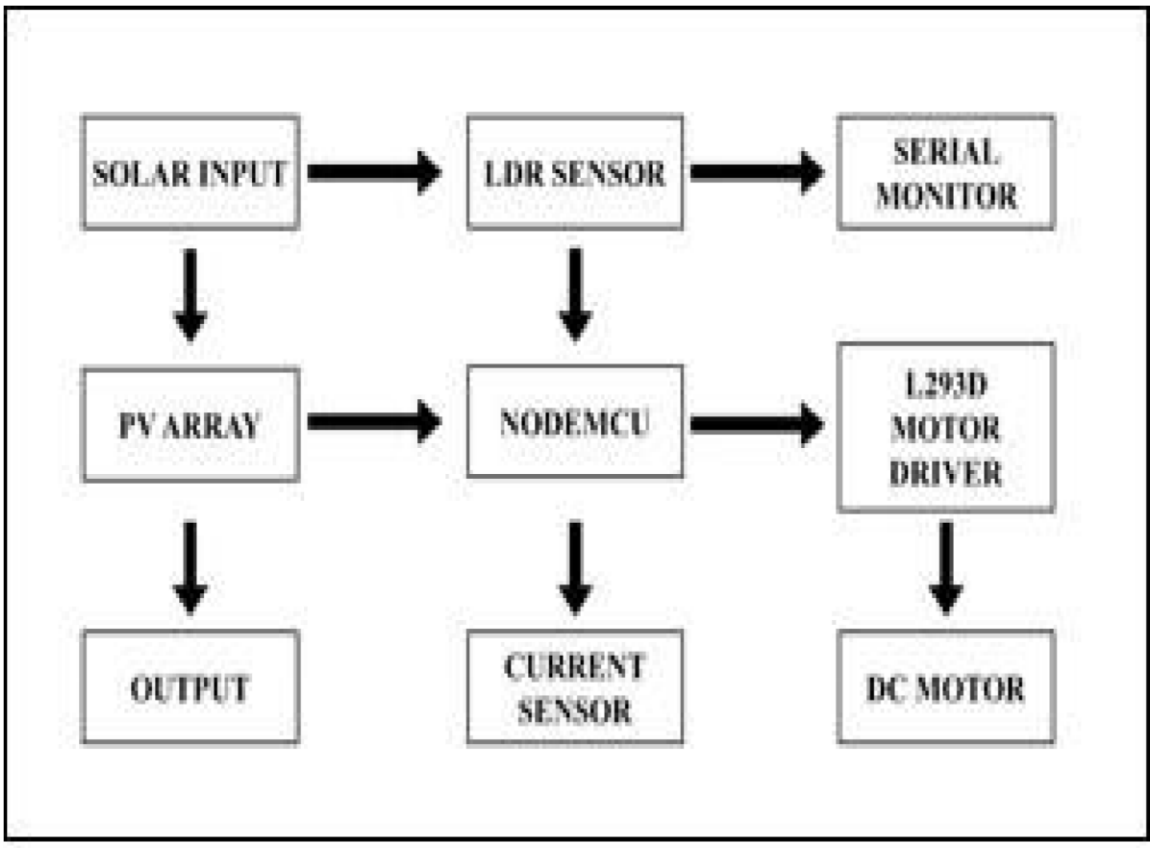


Figure 22: Block Diagram of Automatic Solar Tracking System

CHAPTER 4

METHODOLOGY

IMPLEMENTATION

The project called "Automatic Solar Tracking System" is produced

installation of the various nitty-gritty such as solar panel which provides 12 volts as output, an NodeMcu as MCU, a motor driver – with IC L293D, two LDR sensor module, a 10 r.p.m. simple DC motor, a current sensor and a 9 V battery.

Construction of the said project is being built out of the wooden base installed at the ground of it, affixed with the iron rods on both the sides in a cross-shaped manner connected with a hollow cylindrical rod from both the sides and the DC motor is clinging at one edge of the hollow rod. Three-fold sections into which the circuit of the solar tracking system is divided. input stage has two LDR sensor modules are annexed to the scaffolding with Node MCU analogue inputs. The light dependent resistors are then affixed along the length, on either side of the solar panel.

Node MCU provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

Before being consolidated into one system, three independent stages are engineered independently. This approach, similar to stepwise refinement in modular programming, has been employed as it ensures an accurate and logical approach which is straight forward and easy to understand. This also ensures that if there are any errors, they are independently considered and corrected

Effect of light intensity

Variation in the intensities of light plays a significant role in depicting the amount of power output. This change in intensities monitors all the technical criterions such voltage, circuit current, efficiency, shunt resistance etc. As a result, higher the intensities of light, greater is the power output.

RESEARCH DESIGN

Contemplating the idea of building the said project, the idea that has been conceived primarily is to make the best use of solar energy. The next path that unravels is firstly the method to be adopted in storing the solar energy at its maximum level which further ends up with hatching of the project called

"AUTOMATIC SOLAR TRACKING SYSTEM''. Culminating towards making the said project caviar in its utilization several components have been unleashed, some of which are mentioned so- 1. Solar Panel,

2. DC Motor,
3. L293D Motor driver module,
4. Microcontroller NodeMcu,
5. LDR sensor module,
6. Current sensor,

All in consolidation of the said components the concerned project is orchestrated, ought to seek for imbibing the sun rays at its maximum level through the LDR sensor module etched on the edges of the solar panel in accordance with the length of it, revolves in aid with the DC motor by maintaining the proportionality of

the Sun's movement. Therefore, the genesis lies upon the fact of making solar energy a profitable source in the production of various other aspects which are in rest with the acute need of the society. In addition to which it would solar system.

APPLICATIONS OF SOLAR TRACKING:

Solar trackers are devices used to orient photovoltaic panels, reflectors, lenses or other optical devices toward the sun. Since the sun's position in the sky changes with the seasons and the time of day, trackers are used to align the collection system to maximize energy production.

Several factors must be considered when determining the use of trackers. Some of these include: the solar technology being used, the amount of direct solar irradiation, feed-in tariffs in the region where the system is deployed, and the cost to install and maintain the trackers.

ADVANTAGES:

- The investment is done only during the installation of solar panels, the expenses of acquired solar energy after installation is little.
- Solar energy is a perennial source of energy.
- There is no adulteration is the process of acquiring solar energy.
- The yield rate is very high, using solar panels.
- It requires the least maintenance, once the setup is installed.
- Solar energy is very useful and can be easily drawn into applications in rural areas where the extraction of electricity is difficult.
- Solar energy does not create noises compared to the noises created by the machinery in the extraction of other natural resources

DISADVANTAGES:

- Solar trackers are slightly more expensive than their stationary counterparts, as they are regarded as complex systems with moving parts.

- Trackers require more maintenance than fixed systems. The type and quality of solar tracking system governs how much maintenance the system requires and how often.

- All tracking systems need a great deal of site preparation. Additional trenching for wiring and grading is required too.
- Financing tracking projects is seen as a more complex and high-risk venture from a financier's viewpoint.

- Solar trackers are not conducive with snowy weather and are only suited in hot climates. Contrast this with fixed systems that are more weather friendly than tracking systems.

CHAPTER 5

RESULT

Fig 4.8 completing structure of solar tracking system

CONCLUTION:

Today in the world of rampant productivity, energy is the fundamental source upon which the whole civilization is based upon. As it is said that energy can neither be created nor be destroyed and, in that response, it can be signified that it can somehow be stored. The attempt towards making such goal substantiated, this project has been endeavoured towards unravelling the path of such objectivity. It is quite natural that constant utilisation of energies somehow opens the door of scarcity as per as earthly sources are concerned. Sun, in the stand of which, the tallest source, spiked over for age's right from the origin of the whole universe,

through which life has been conceived, is the basic and the mother source of all the energies. Considering the very fundamental from the viewpoint of storing such energy, the project has been unravelled. Energies other than from the Sun, are the process from which such are been produced through the burning of various materials, involving emission of a large amount of pollution, causing the environment and the atmosphere sick day by day.

In that regards it would be worthier to reveal that commercialisation has boomed its wings to such an extent in the need of money and power that we are somehow present in the pool of acute ignorance of the world's resources scarcity, in consequence of which the whole world is wounded. Healing the world is the basis cultivation with which the hour clock is calling and this project presents the eye, therefore, to open the corridors of reducing the amount of pollution in storing of energy culled out from the Sun and also to make the pace of advancement revved around.

SOURCE CODE:

```
#include <Servo.h> Servo
myservo;

int ldr1 = 4;
int ldr2 = 5;
int val1; int
val2; int
pos=90; void
setup()
```

```
{
  myservo.attach(11); Serial.begin(9600);
  myservo.write(pos);

}
void loop()
{
  val1 = analogRead(ldr1); val2
  = analogRead(ldr2);

   val1 = map(val1, 0, 1023, 0, 180);
   val2 = map(val2, 0, 1023, 0, 180);
                    if(val1 > (val2+50))
  {
    if(pos<180) pos=pos+1;
    myservo.write(pos);
    Serial.println("backward");
    delay(10);

  }
  else if(val2 > (val1+50))
  {
```

```
    if(pos>0) pos=pos-1;
    myservo.write(pos);
    Serial.println("forward");
    delay(10);

  }
     }
```

FUTURE SCOPE

The very embodiment through which the futuristic conundrum be set aside, is the project called “Automatic Solar Tracking System”. A trailblazer by its spirit, this system works in its utmost efficiency, whether that be in terms of its pecuniary ability or in terms of its accessibility. In the smoke of the darkness where pollution engulfing every spheres of advancement as an outcome of producibility, this device in its very efficiency work towards only advancement and development by flushing out the pollution at large.

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